



The Interdisciplinary Communities of Practice of the Karst Information Portal

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Introduction

The Karst Information Portal (KIP) (<http://www.karstportal.org>) is a publicly-accessible Internet portal for karst literature, data, and community hosted by the University of South Florida (USF) libraries. It was created to foster interaction and collaboration among the karst community by identifying, acquiring, and facilitating access to karst literature in a single, centralized location. Karst is a type of terrain typified by soluble rocks, such as limestone, gypsum, and dolomite, where solutional processes are dominant, forming sinkholes, depressions, caves, and enhancing underground drainage. The karst community consists of two distinct components: professionals (i.e., scientists, researchers and academics) and amateurs (generally cave enthusiasts). The multidisciplinary fields of karst research include geology, geography, hydrology, biology, paleoclimatology, urban planning and economics. Karst research is conducted in both public settings like universities, government-funded institutes, as well as private organizations, like insurance companies and environmental consulting firms.

In support of the strong karst research at USF, the USF Libraries have selected karst studies as an area of critical concentration and the Nelson Poynter Memorial Library at the USF St. Petersburg campus supports interdisciplinary Florida Studies research and education. As Florida's karst environment offers great research and instruction opportunities for USF researchers, Florida's cavers have become an important community for interdisciplinary karst researchers and the USF Libraries. While it is the professional karst community that generates the bulk of the scientific knowledge of karst, cavers are often able to provide detailed field notes of karst sites

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that include maps and painstaking descriptions of caves. In addition, the cavers act as gatekeepers to the caves by controlling the cave location information. They have the ability to dictate who learns about the cave locations and, when gated, who can gain entry. Without developing relationships with members of Florida's recreational caving community, karst researchers at the universities and at governmental agencies at the local, state, and federal levels would be seriously hindered from conducting their research. In this way, both halves of this professional and recreational community have something unique to contribute to the growing understanding of karst environments. Within this context, the research into the karst Communities of Practice (CoPs) is a valuable means to assess knowledge development, sharing, and management of local cave information and the factors that facilitate or inhibit participation in the KIP.

Communities of Practice Model

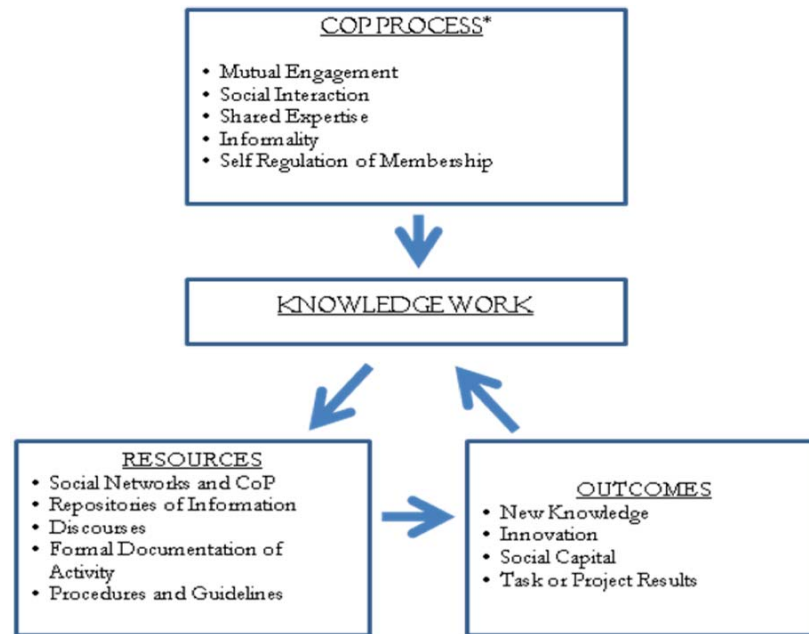
Bound together by a shared passion and expertise, the concept of Communities of Practice (CoPs) describes an informal web of relationships that facilitates learning through social interaction, knowledge sharing, problem solving, information production, and the development of innovative techniques (Wenger, 1998). The notion of "practice" connotes the endeavor, within a historical and social context. In this context, the activity acquires meaning thereby defining membership, the proper methods to conduct the activity, what information should be collected, and how it should be communicated.

Wenger (1998) argues that information is most easily shared among CoP members when a relationship of trust has been established. Trust among CoP

members is primarily built in two ways: 1) through social interaction and 2) through familiarity with a person's ability, expertise and competency. Formal CoPs are working groups that focus on a specific problem that needs to be rectified, while informal CoPs lack a definite purpose, but share a broad set of goals such as practicing together, knowledge sharing, problem solving, or learning new techniques or technologies.

Over time a CoP will develop a shared set of resources such as the methods and tools to conduct the activity (Stein, 2005). Through the cooperative use of these resources, the CoP can promote creativity, improve its practices, create innovative techniques, and expand its knowledge base. Repositories of information are created when the CoP requires a more formalized system to manage, share, and build upon the methods and knowledge surrounding their shared activity (Koeglreiter et. al., 2006).

CoPs are valuable for their ability to manage knowledge assets, but also for their utility (Wenger, et. al., 2002). Organizations value their ability to save time and money, expand the knowledge base, develop standardization of practices, and create innovative solutions to problems. Members of a CoP receive short term benefits by getting help with their activities, receiving guidance from a variety of perspectives, and receiving community support for their risk taking. In the long term, the members of CoPs develop greater expertise while staying abreast of the latest developments surrounding their activity.



* Koeglreiter et. al., 2006

Only recently has research begun to examine some of the less positive aspects of CoPs, such as whether CoPs can be managed, whether CoPs can even exist if community members do not get along, issues of control over individual versus collective information, and how issues pertaining to power influence the CoPs activities, membership, and future goals (Pemberton et. al, 2007). These issues will be explored in greater depth in the discussion section of this article.

The Karst Information Portal

Karst science faces information-related challenges that are not commonly found in other scientific disciplines. Vital data are scattered across an array of academic fields; a single project could draw upon concepts rooted in fields as diverse as ecology, geology, hydrogeology, paleontology, toxicology, engineering, and geomorphology. In a social science context, focus on karst research can involve law, tourism, history,

geography, urban planning, science education, and natural resource management.

While karst-related research regularly appears in the peer-reviewed journals read by practitioners of these disciplines, examination of raw karst data often requires scouring difficult-to-find gray literature sources.

As with any other scientific field, the advancement of karst science is tied directly to access to existing karst-specific data and knowledge. Examples of important forms of knowledge in karst science include articles published in academic journals, unpublished government or technical reports, cavers' maps and notes, or oral histories. Except for published journal articles, which are relatively easy to acquire, much of the existing body of karst-related knowledge is stored in various locations all over the world, and can be notoriously difficult to acquire; in particular, important and unique cave data are often controlled by amateur speleological clubs that may lack the resources or the inclination to make that data available to the wider karst community. Integrating and linking these information sources with the broader karst community is the first step in learning to address karst-related environmental issues without significant duplication of effort among researchers.

It was with this goal in mind that the Karst Information Portal (KIP) was developed. KIP (<http://www.karstportal.org>) is in the process of locating and acquiring karst-related content, with an emphasis on gray literature and raw data that have historically proved to be difficult for researchers to find. KIP was conceived in 2005 and rolled out two years later, in mid-2007, as a partnership between the International Union of Speleology, National Cave and Karst Research Institute, University of New Mexico, and University of South Florida. The project's goal was to promote integration of karst

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knowledge through the creation of a comprehensive, community-driven centralized knowledge repository. This repository includes gray literature, raw data, and published journal articles. KIP combines features of a web portal (i.e., it provides connections and links to information and data available elsewhere on the World Wide Web) and a traditional database (i.e., it stores some data locally, which can then be searched and retrieved by users). By collecting this material together in a single space on the Internet, KIP both facilitates and guarantees long-term access to these resources. This is especially useful in instances where resources that have previously been available only in hard copy form are converted to electronic format and uploaded to the portal.

KIP is simply a browser-based, platform-independent application powered by SQL databases. Navigation within the portal is conducted via a series of tabs, each providing access to a different content group, and is facilitated by static links in the footer. Users can conduct federated searches of the entire portal, or conduct more focused searches within a particular section of the portal (i.e., the catalog, the forum, or news). Searches may also be refined based on geographic location, document type, language of resource, or the inclusion of specific terms based on UIS Speleological Subject Classifications. The information core of the KIP project is accessible via the **Resources** tab, which contains links to and tools for searching the entire KIP catalog. Users have direct access to current and archived content for several online karst-related peer reviewed publications, including *Speleogenesis*, *Journal of Cave and Karst Studies*, and *Acta Carsologica*.

Project partners had envisioned an environment in which growth of the content catalog would be driven by the portal users themselves. This goal was part and parcel

of the larger theme of community-building, in that it was meant to encourage knowledge-sharing among members of the worldwide karst community. To facilitate this, the portal design includes a prominently-featured button that initiates the content contribution procedure; this button is accessible from every web page within KIP. All items contributed by users must be approved by KIP administrators prior to inclusion in the catalog, as a means of ensuring the catalog's contents stay relevant to the karst community at large. As of April 2008, KIP's catalog contained over 4,000 unique items. The contribution button, however, has not been utilized as often as KIP's project partners had originally hoped. While there are, from time to time, individual submissions of content from portal users, for the most part growth of the portal's content catalog has been driven by permanent KIP employees.

On the **News** tab, one finds announcements of upcoming karst-related events, new publications on cave and karst science, and important research updates. Users can subscribe to an RSS feed that will deliver updates to them as they are made, and they may also submit their own newsworthy items for inclusion on the portal. In fact, this last step is a critical part of the process, as KIP relies on its user base to a significant degree for content updates.

Finally, the **Community** tab houses features that are intended to open lines of communication and build linkages between members of the cave and karst communities. For example, users can use the **Forum** to initiate and participate in conversation threads on karst-related topics. The Forum is open to all registered users of KIP. Users are strongly encouraged to register with KIP, and may do so in a matter of minutes via the portal's main page. While it is certainly possible to use KIP without

registering, one is required to register in order to contribute to the collection and to participate in the community-based features of the portal. KIP managers consider the portal's collaborative and community-building aspects to be among its most important features; as more and more users register, these features will become more robust.

Methodology

Through qualitative, in-depth interviews, key informants within the local West Central Florida karst CoP were interviewed with regard to their data collection, knowledge sharing, and awareness and prospective use of the KIP. These key informants were recreational cavers with knowledge and experiences with caves in West Central Florida and were active in creating, collecting, archiving, or controlling karst related information. Altogether 14 informants were identified; 11 were men and three were women. In addition, several informants' professional lives also involved karst such as a biologist, geologist, a county planning manager, and several university graduate students. Informants were interviewed in person and the interviews were recorded during the summer of 2007. These coincided with the initial public testing of the KIP, but preceded the formal public release. While the KIP was not the initial focus of the interviews, the role of karst information collection and sharing quickly emerged as a theme. In addition, the interviewer met or communicated (in person, through email, and phone) with several informants since their interview and has had ongoing discussions on Florida karst related events, the KIP, and information sharing. Interview transcription occurred during spring 2008. Pseudonyms and other characteristics that may identify informants are used throughout this article to hide the identity of the

informants. While this paper represents the ongoing research, the information collected thus far is sufficient to apply the communities of practice model to Florida's cavers and relate their culture to the development of the Karst Information Portal.

West Central Florida's Karst Community of Practice

The karst community is an active Community of Practice with both formal and informal modes of organization. Steeped in a culture of secrecy, the knowledge of cave locations is carefully guarded throughout the United States. To limit disturbance, cave locations are exempt from the U.S. Freedom of Information Act and the National Speleological Society (NSS) discourages its members from publicizing or publishing cave locations (Kramer, 2003). On the local level, CoP activities are fluid and informally structured. Many grottos (local NSS recreational caving groups) were formed as social clubs but also act as the organizational guardian of cave locations (Kramer, 2003).

To the lay person, a caver is someone who goes into caves; however, to recreational enthusiasts a "caver" is defined as someone with a deep interest in caves who is willing to develop the techniques and attitudes that allow him or her to cave safely and sensitively without disturbing the cave environment (Mike). People who enter caves with the intent to vandalize or party in an exotic location are disdainfully not considered cavers (Dave, Mike, Greg). Cavers are also defined by their participation in the social activities of caving, such as being members of a local grotto or the National Speleological Society and actively caving and building up their karst knowledge and technical expertise (Peter, Dave). The subcategories of active cavers are those individuals who go caving a minimum of four or more times a year (Carson), while

“project” cavers like to take a particular cave or karst region and study it (Greg). Florida currently has four active grottos, the Central Florida Grotto (based in Orlando), the Flint River Grotto (Northern Florida Panhandle), the Florida Speleological Society (a former University of Florida Student Group in Gainesville), and the Tampa Bay Area Grotto. The Florida Cave Survey (FCS), a non-profit organization, is essentially a database of Florida cave locations and descriptions.

Caving offers individuals a variety of recreational experiences such as hiking, crawling, swimming, and photography. Several cavers described the thrill of exploring new places that potentially no human has ever entered (Greg, Carson, August) and the need to fill in the “knowledge gaps” about the unexplored underground environment (Greg). Several informants concentrated on “ridge walking” and looking for “blowing air,” meaning they regularly searched for new caves by feeling the ground for air coming out of the earth representing some sort of underground void (Carson, Rob). Another informant said that he was primarily interested in exploring and mapping caves, trying to see how far a cave system could extend (August). One caver liked conducting biological inventories of a particular karst area, both inside a cavern and above the cave system (Greg). Several cavers, (Greg, Mike, Carl, Carson, Peter) argue that cavers have a duty to explore and collect cave information. In total, all of the cavers interviewed placed a great value on the exploration and study of the karst environment.

Sharing and disseminating this information, however, is not as positively perceived due to various risks associated this activity. Caves are a fragile but dangerous environment (van Beynen & Townsend, 2005). Serious caving accidents occur throughout the United States. Caves can be a magnet for illicit activities. Cave

environments are also easily disturbed by numerous visitors and individuals who enjoy wantonly destroying fragile formations or vandalizing the environment. In addition, most cavers are worried that land owners and cave managers, who are concerned about their liability should an accident occur, will deny access. As such, cavers need to trust that others will be careful, not become claustrophobic, and have the technical expertise to crawl, twist, and otherwise maneuver through tight spaces. The cavers also need to trust that other cavers will take any scrapes and minor injuries in stride, and not threaten to sue the property owner, the cave manager, or their caving companions. Finally, caving frequently involves trespassing on private property, thus the size and timing of caving groups must be controlled in order to avoid drawing unwanted attention or scaring the landowners.

Trust among cavers is developed through caving, recognition of expertise, and participation in cave related activities. Beyond commercial caves or a few well known caves on public lands, individuals interested in caving need to contact a grotto to learn about cave locations. All of the Florida grottos have websites and can be easily contacted. But grottos are very protective of their information and don't give out the cave locations easily (Mike). When he first joined a grotto, Carson described how he had to volunteer at a caving exhibit at a local science museum and co-supervise several caving boy scout field trips before any of the grotto members trusted him enough to take him caving (Carson). In addition, proving caving ability is an important means of gaining trust. Cave location information and invitations on caving trips are also carefully doled out to newer cavers. Dave, a manager of several caves, regularly denies access to people who had been on fewer than five caving trips; Peter, a newer caver, found that

demonstrating concrete improvement in his caving ability was necessary before the more experienced grotto members would invite him to explore new caves on a regular basis.

Networking is also important to cavers. Several informants iterated that they only trust cavers that they know or have personally caved with. According to Mike, Florida's recreational caving community is relatively small and most cavers know each other. In contrast, Carl, who was both a recreational caver and professional geologist, argued that except for a handful of individuals, recreational cavers and karst scientists—who cave as part of their job or research activities—do not necessarily interact. However Peter, Simon, and August, all karst graduate students, countered that they had to go on social caving trips, engage in grotto activities, and intentionally become recreational cavers in order to conduct their scientific research.

Constructed to facilitate recreational caving in Florida, the Florida Cave Survey (FCS) is a database of cave descriptions and locations. In contrast to the grottos, the Florida Cave Survey is not a social club, and has a more extensive and formalized membership process. Potential members must be invited to join and sponsored by at least two other members. Once the member has been invited, s/he is an associate member for one year, during which s/he does not have access to the cave database. In addition, during this probationary year the associate members must actively cave and need to contribute to the FCS by finding new caves, conducting cave surveys, and turning this information over to the FCS. After a year, the general membership assesses the productivity of the associate member to determine whether s/he should become a full member.

While most of the cavers valued the importance of developing caving skills and expertise, many criticized the restrictive aspects of the relationship building process. Some individuals who approach the grottos or the Florida Cave Survey became very frustrated with the secrecy and control over cave location information (Mike, Carson). Many of these individuals do not become grotto members and thereby do not join the CoP. In addition, even grotto members can become frustrated with the membership vetting process. When Simon, a member of grotto A tried to gain access to a cave managed by grotto B, the president of grotto B required him to be interviewed about his caving experience, the purpose of his caving request, and mandated that Simon attend grotto B's meetings, an inconvenient two-hour drive away (Simon). Simon circumvented this verification process by asking a friend to ask another friend who was a member of Grotto B for the key to the cave gate. In another example, Peter similarly circumvented the FCS's membership process by asking a member friend for cave location information, rather than waiting a year for the end of his FCS probationary period.

A lack of trust between many Florida cavers is clearly apparent. A major schism in the past several years developed between the various grottos after several new caves in Central Florida were discovered (Mike, Greg, Carl, Carson). Many cavers were unhappy with the level of secrecy surrounding the caves, particularly as one is now considered to be Florida's most pristine and decorated cave. August, a graduate student, was only able to do his research of caves throughout Florida because he caved with members of all the grottos without ever officially joining any single grotto. As such, he didn't let himself become identified with any one group (August, Peter).

Characteristic*	Value
Knowledge domain	Caving, Caves and Karst Science
Set of interested and interconnected participants	<u>Recreational Caving Organizations</u> <ul style="list-style-type: none"> - Florida Grottos - Florida Cave Survey <u>Karst Researchers</u> <ul style="list-style-type: none"> - Florida Museum of Natural History - University of Florida - University of South Florida <u>Government Agencies</u> <ul style="list-style-type: none"> - County Zoning and Planning - Florida Department of Environmental Protection - Water Districts - USGS
Opportunity for ongoing processes of sense making, knowledge of sharing and discovery within the domain of interest	<u>Mutual Engagement and Social Interaction</u> <ul style="list-style-type: none"> - Caving together, - Surveying new caves, - Attending organizational meetings, lectures, - Creating Cave exhibits for schools, museums, - Creating membership newsletters, websites, etc. <u>Self Regulation of Membership</u> <ul style="list-style-type: none"> - Defining who is a caver - Questioning of motives - Questioning regarding who you know - Defining who can gain access to cave information. <u>Shared Expertise</u> <ul style="list-style-type: none"> - Primarily experience and caving ability - Surveying and mapping ability, - Biological and GeoScience knowledge.
Set of resources related to the domain of interest including methods, tools, theories, etc.	<u>Methods</u> <ul style="list-style-type: none"> - Proper caving techniques, - Surveying, - Inventorying <u>Knowledge Produced</u> <ul style="list-style-type: none"> - Cave maps, - Management plans, - Cave/karst databases of - Cave locations, - Biological and geological inventory - Cave history and literature, - Photographs and ephemera. - Publications - Discipline of Speleology <u>Emergent Theories</u>

	<ul style="list-style-type: none"> - Role of secrecy as tied to cave conservation - Best management practices
Processes by which the community maintains and refreshes its membership	<ul style="list-style-type: none"> - Caving trips - Classes and educational field trips - Grotto websites - Museum displays - Student groups - Articles or documentaries for general public consumption

* Adapted from Stein, 2005

Cave Knowledge

Many cavers document their caving activities and trips through a variety of means. Some keep a database of the caves that they've visited; many others upload their photographs onto Flickr. All four of the Florida grottos maintain their own websites and publish reports about fellow members' activities, trip reports, management plans, and other activities such as cave cleanups and gating. While all of these activities chronicle the social, recreational, and management caving activities, several key individuals have collected, produced, and organized much more extensive information. In this next section, we outline, in an informal to formal order, some of the data collected and knowledge produced by cavers in West Central Florida.

Cave Photography

Many of the recreational cavers are active photographers, both amateur and professional. For example, Carson regularly photographs caves and grotto caving trips. In addition, in his quest to protect a recently discovered cave from development, he has extensively photographed the stalagmites and stalactites, the cave system, and the pine hammock above the cave system. At first he shared these photos with the caving

community through the NSS News, but as the cave became more threatened with International Federation of Library Associations, Social Science Libraries Section, Satellite Conference, *Disappearing disciplinary borders in the social science library - global studies or sea change?* University of Toronto, Toronto, Canada, 6-7, August 2008

development, he started sharing the pictures with the general public by giving them to a local newspaper and showing them at a county planning hearing. More recently he has uploaded his pictures on Flickr in a photo and video essay describing the cave, its decorations, and advocating for its preservation and protection from development. Outside of her caving activities, Cindy is a professional photographer. Yet, she has applied her skill by recreationally photographing caves in Florida and throughout the world for several decades. Additionally, when the Florida State Caverns Park was first being created, she photographed the caves and helped initially document the Park. All of her photos have been donated to Carl's private library, which will be discussed below.

Cave Pathfinders

Carl was a professional geologist and active caver for several decades. Over time, he has collected an extensive private library of cave books, maps, photographs, articles, and technical reports. As part of the recreational caving community, he has collected the maps, surveys, and inventories from his fellow cavers. As a professional geologist, he has kept all the reports from his karst consulting business, as well as collecting technical reports and scientific publications from his colleagues at the Florida Geological Survey, the United States Geological Survey, the University of Florida, and the University of South Florida. For the past several years, Carl has been actively organizing this information in an Excel database and has been creating a pathfinder for every known cave in Florida. Every cave is coded and a bibliography links all the

documents that reference that cave. Currently, he is digitizing these documents and linking their files to his private Google Earth map.

Karst Biogeography Datasets

Greg, a retired biologist, describes himself as a “project caver.” His hobby is to study a karst region and do a thorough cave exploration and biological survey. He is particularly interested in identifying cave species such as crayfish, salamanders, and bats and tracking their ranges. This data is stored in his own biogeography database. While this work is his recreational activity, he also gathers his data for several formal organizations. For example, when he finds an unidentified species, he collects a sample and sends it to a taxonomist, any cave crayfish and bat sightings are sent to the Florida Natural History Museum biogeography databases, and a copy of his cave maps are sent to the Florida Cave Survey. In addition to this data collection, he also undertakes more analytical projects. Currently, he is mapping all the caves, and conducting a biological survey of the flora and fauna in and above the cave system at a state park. The park managers are unaware of his activities, but when completed, he plan to give them a complete report of the park’s cave systems and biological life.

Cave Management Plans

Once organizations, such as local grottos, the National Speleological Society, cave conservation organizations, and state parks begin to actively manage their caves, one of the first projects is to create a management plan. The management plan

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describes the organization's cave related goals, documents the caves history, assesses its biological, geological, hydrological, paleontological, archeological, and historical resources, develops an access policy, and outlines a resource management plan for the cave and the land above. These cave management plans can range from a simple brochure (Dave), to a website, to a formal publication with annual reports to a conservation organization or park managers (Jane, Simon, Greg, Jerry).

Cave Maps

Exploring and mapping caves is a key interest of several informants (August, Carl, Greg). Cave maps are a popular gift to private landowners who allow the recreational cavers on their property. Citing the lure of more exploration, some cavers continually date and label their maps as "draft," hoping at some point that they can find new tunnels or caverns and expand the size of the cave (August). Publishing these maps in public forums such as personal websites, Flickr, or in newspapers is generally discouraged (Carson, Peter). However, many of Florida's underwater caves (explored and mapped by cave divers) are openly available on the internet and many recreational cavers proudly send their maps of popular or newly discovered air filled caves to the NSS News.

Florida Cave Survey

The Florida Cave Survey is a compendium of information on the location and character of caves and notable karst resources in Florida. The Florida Cave Survey has a primarily recreational purpose, and serves as a means for Florida's recreational

cavers to share information among its members about cave locations and access issues. The FCS has approximately 40 members and is separate from the Florida grottos, but members come from all of the grottos and from across the state.

The FCS was first started in 1964 and has since gone through four different versions. Before the current version, the FCS was created, recreated, and lost three times (Carl). Generally, the substance of the FCS has not changed over time. The key bits of information are the cave name, location (longitude and latitude, or general description of how to get there), cave ownership (public, private), whether it is a wet or dry cave, the cave size (length, depth and map if available), access issues (is the cave gated or not, who has the gate key, do cavers need to sign a liability waiver), and notes on the characteristics of the cave (biological and geological features). The storage technology of the FCS has changed over the years; the original FCS was a shoebox of index cards while the latest version is loaded in an Excel database and distributed to the membership on CDs.

The Florida Cave Survey has identified approximately 4000 air filled and underwater caves in Florida (Carl). According to several of the executive members of the FCS, the biggest shortcoming is the lack of consistent cave information (Mike). For example, the cave entrance information could range from GPS coordinates to a vague description such as, “park at the end of the road, walk west for 30 minutes, and the cave entrance is on your left.” In addition, new cavers interested in exploring and ridge walking, continue to find new caves. But as the Florida Cave Survey has been created and lost three times before the current version, older cavers are skeptical whether some of the “new” caves really represent a fresh discovery or duplicate incomplete or

inaccurate past information (Carl). The FCS members are attempting to improve the consistency in the cave names and descriptions and to that effect have adopted a standardized data key.

In 2004, the Florida Geological Survey began a project called the Florida Cave Database (Kincaid, 2004) to collect cave maps and make them compatible with other GIS-based hydrogeological databases. The purpose of the Florida Cave Database was to help the state agency monitor water quality and quantity as well as improving the state's planning and zoning activities. Members of the Florida Geological Survey approached the Florida Cave Survey's executive members to discuss whether they could incorporate the FCS's cave maps and data into the new state database.

The Florida Geological Survey's request further divided the FCS members. Some informants argued that the FCS is a recreational database and that the cave locations should be kept secret to all but the membership. Others vehemently countered that public officials, scientists, and state environmental and planning agencies would greatly benefit by knowing the locations of Florida's caves and sinkholes. Other recreational cavers, less concerned with the science, believed that all interested individuals should have the right to access caves, particularly those located on public lands (Carson). All members of the community worried about the repercussions involving cave conservation and human safety if the FCS became publically available. Ultimately, the FCS decided against sharing their database due to worries about the Florida Sunshine Law and the ramifications of cave locations entering the public domain.

According to the Florida Sunshine Law, every person has a Constitutional right to inspect or copy a public record at the state and local level (Office of the Attorney General of Florida, 2005). Public records are any materials made or received by a state or local agency and can consist of traditional written documents as well as other media such as photographs, and film and sound recordings. Some exemptions to this law exist; for example, the Florida Legislature approved the exemption of archaeological sites. However, when the FCS and Florida Geological Survey approached the governor to gain exemption for cave sites similar to that of the archaeology sites, they were rebuffed. As such, all discussions transferring the FCS to the Florida Geological Survey have been shelved, until the Florida Governor and the legislature grant caves exemption status under the Florida Sunshine Laws. Without the addition of the Florida Cave Survey's records, currently the Florida Cave Database created by the Florida Geological Survey contains only 31 of Florida's underwater caves and has not been updated since 2004 (Florida Geological Survey, 2004).

Discussion : Community or Practice? A Bridge to the Karst Information Portal

Within the theoretical debate over whether the "community" or "practice" is most important in defining a CoP (Pemberton, et. al., 2007), we would argue that the karst community represents all the individuals that engage in karst, but the practitioners in this case study are specifically those individuals who cave. Both are equally important sectors of the CoP and are very fluid and interdependent. Karst researchers cave for their field work, graduate students join local grottos, develop friendships, and cave recreationally, and recreational cavers read scholarly books and study karst research

for their general interest (as we have demonstrated throughout this paper, the cavers are extremely productive in the collection and creation of new data, information, and knowledge). While the West Central Florida karst CoP has a decided lack of trust among its members and deep divisions due to secrecy, data collection, and control over knowledge, they continue to be an extremely active CoP in terms of social engagement, conducting the practice of caving, and generating and exchanging knowledge. As Werner pointed out (1998), the membership within a CoP does not necessarily mean that everyone has to get along or agree. As with the karst CoP, despite this dissention, it is the practice that keeps the CoP productively engaged.

Currently researchers wonder whether an informal CoP can be actively managed (Pemberton, et. al., 2007). This question has great bearing on the karst CoP and the KIP. Much of the community originally developed as an informal caving recreational and exploration society, but is increasingly formalizing its membership and activities. This increased formality is potentially due to increased threats to the communities' practice. These threats range from a reduced access to caves due to increased land development, private property owners denying access to caves, greater environmental disturbance, and the informal and fragmented nature of the CoP itself. While the grotto members and FCS have tried to collect and organize cave information several times in the past, the lack of CoP institutional memory has hampered the exploration and the study of Florida's karst environment. As the CoPs efforts are voluntary, the interests and dedication of individuals can change over time; members move on to new places, new activities, or new social groups, and the information they amassed can get lost. While the grottos and FCS do designate executive representatives, to a large extent the

CoP is a leaderless community that is not being formally managed or directed, and individuals are not bound to the dictates of any executive decisions. In addition, various members offer competing visions over the future role of the CoP's collective information. While we do not know how these issues will be resolved, the KIP can introduce new techniques, protocols, and means of social engagement that can reduce the CoP's information related tensions.

The Karst Information Portal, a formal means to organize and manage this information, is an ideal means to resolve many of the information impermanency and management issues. While the KIP, unlike many corporate institutions that seek to profit from their employees CoP activities, does not want to manage the karst CoP, it does want to fulfill the traditional role of libraries by preserving, storing, and organizing information, while expanding into the role of facilitating knowledge communities. The main unresolved discussion questions are: how KIP can raise awareness within the karst CoP, whether KIP can gain the CoP's trust, how to protect individual control over information valued by the community, and how best to facilitate engagement from all sectors of the Community of Practice.

Raising Awareness

It is important to ascertain why the community-driven aspects of the portal have so far gone underutilized. The amateur karst and cave enthusiast community seems to be less eager to participate in KIP than do members of the professional karst community. An examination of the affiliations of KIP's list of registered users bears this out, as most indicate some kind of professional institutional affiliation rather than an

affiliation with a speleological club. To date, KIP staffers and project partners have taken a traditional approach to promoting the portal and engaging the karst community, via presentations at national and international karst-themed meetings and conferences (for example, the annual meeting of the National Speleological Society) and outreach efforts to relevant groups and audiences. There has also been significant reliance on informal personal networks and using those to spread awareness by word-of-mouth; much of this has been focused on the professional karst community.

On the local level, this case study found a general lack of awareness about KIP among the West Central Florida recreational karst community. Bridges between the scientific, professional, and recreational community are a great means to raise awareness of KIP and to advocate for its utility and community. Many people in the caving CoP are likely to be familiar with a few famous names in karst research, but not necessarily with the larger, younger, and more intellectually diverse generation of karst researchers. Recreational cavers who attend the National Speleological Society's annual meetings often attend lectures from and interaction with some of the less well-known names in karst. Faculty and graduate students in the karst sciences are uniquely positioned to promote KIP among both the caving CoP and the professional karst community. The nature of their studies brings these students into contact with professionals in the karst world on a regular basis; the fact that they are often avid cavers themselves enables them to cross the line between the amateur and professional karst communities without being seen as "interlopers." Increasing the role of graduate students in outreach for KIP could help overcome caver concerns about

information sharing, especially since the students are often already trusted members of the CoP.

Protocols for Trust

Ultimately, the relationship between KIP and the West Central Florida caving CoP are characterized by inherent tensions between building the resource and control of the information that goes into it. Certainly the karst community benefits from the open distribution of karst information from a readily-accessible, centralized location. However, the very behavior it seeks to promote—the sharing of karst information and data—are directly tied to some of the challenges increasingly confronted by the CoP.

Trust is a critical component in getting buy-in from the caving CoP. As described previously in this paper, cavers have expressed reservations about publicizing cave locations. This secrecy was considered during KIP's design phase. Because KIP staff recognized that there would be situations in which information owners would agree to share their information only under the condition that access to it was restricted in some way, it is possible to specify which category or categories of KIP users (everyone, registered users, researchers or project partners) have access to uploaded catalog items. Generally, by restricting access to researchers and project partners, cavers could be assured that their cave location data is not likely to leak out beyond the karst community; indeed, many cavers who are registered users of KIP do not even have researcher-level access themselves. Certainly, in order to overcome cavers' antipathy toward sharing sensitive data, KIP would have to make a much stronger effort at caver outreach and education regarding the security protocols of the portal.

Access to cave locations may continue to emerge as an issue for karst researchers. Currently, much of the graduate students' karst research depends on being able to access caves. While some individuals have successfully bridged the divide between researcher and recreational caver in the karst scientific community, future students may have difficulty gaining that level of trust. Unless lawmakers modify the Florida Sunshine Laws in a way that exempts cave locations from the public domain, karst scientists will vigilantly protect the locations of sensitive sites and refrain from disclosing them to public officials or governmental stewards for the environment.

One option that protects the sensitive data from broad disclosure while assuring that locations are not "forgotten" within the small network would be to deposit such information within a designated academic library's archives and special collections department. These areas of the library are well versed in managing such information. The archivist or librarian could negotiate a custodial agreement specifically dictating the deed of gift for any sensitive cave information. Although libraries generally encourage free and open access, archives have the ability to work with donors hoping to preserve information for long-term posterity that requires clearly articulated and time-specific restrictions. Examples include restrictions on accessing manuscript collections of authors or politicians until a period of time after their death, as well as access restrictions due to the controversial nature of materials with such collections (medical records, legal documents, items available exclusively to the donor's heirs for a period of time, etc.). Accordingly, the copyright to the cave information would continue to reside with the donor, thereby circumventing the Florida Sunshine Laws dictates to all materials held by state agencies. In a clearly worded agreement with the repository,

this donor could designate who could access the information, while shielding the information from the general public. The deed of gift would also designate the institution's responsibility to archive the information, preserve the integrity of the data and the cave sites represented by the data. As such, within the very framework of the KIP's categories of users and the USF Libraries Special Collections Department, there is a means to protect sensitive cave information while ensuring access to relevant members of the community.

Individual Versus Individual Information Control

Collective control over individually collected cave information is a sensitive topic. While some informants have great technical or scientific expertise, some of the individuals who control the information through the Florida Cave Survey do not. Furthermore, while only a few members of the FCS actually generate new cave knowledge, other recreational cavers expect to have complete access and control over the information and dissemination process. Carl, Simon, and Carson, some of the most prolific CoP members, were in greater favor of sharing cave related information with a broader audience and engaging interested individuals who were not directly part of the local recreational CoP. But these information creators also wanted recognition for their activities and greater control over their knowledge products.

Proposed new features of the portal are envisioned to directly balance the demands for individual information, but ensuring community access. One example is functionality that will make it possible for users to view databases within KIP, and to add new records or modify existing records within these databases. However, most owners

of karst-related databases would be hesitant, if not outright hostile, to the idea of allowing anyone with access to KIP to potentially corrupt the value of these databases by making incomplete, ill-advised or just flat-out incorrect additions or modifications to the existing data. In this particular case, the solution is to require approval from the database owner for each modification to the database. In this way, the original owners of the information retain control over how the information is shared, while portal users gain access to valuable, potentially unique datasets. One trade-off is that such an arrangement requires the database owner to continue maintaining it. If this is not feasible, another possible means of control and verification could be accomplished via Wikipedia-style tagging, where all changes are uploaded as they are made, but administrators retain the ability to revert back to the original version.

Engaging the Community of Practice

From the offset, the creators of the Karst Information Portal have set a high priority on engaging the karst community, yet it is precisely these aspects of the portal that have been slow to find acceptance. Perhaps the foremost examples of this are the discussion forums. It was initially hoped that a certain percentage of portal users would frequently visit the discussion forums, where they would initiate and drive online conversations with their colleagues from around the world. Other users could then follow the conversations or participate, if they chose to do so. Nearly a year after rollout, this has not happened. As of this writing, the KIP forums feature a total of seven topic threads, with a total of seven comments attached to them—five of which are in the thread that discusses the design and functionality of the portal itself. The majority of

these threads and comments have been generated by KIP project partners, and not by members of the wider amateur and professional karst communities.

Obviously, increasing this sort of participation is not simply a matter of adding a new page or feature to the portal. CoP members will participate in the interactive portions of the portal only to the extent they are willing to use it in the first place, which is directly tied to issues of comfort, value, and community niche. Recreational cavers currently have many other discussion forums that they can engage, primarily those hosted by the National Speleological Society. Presumably all of these participants are members of the national CoP, NSS members, and caving enthusiasts. The desire to extend the caving forums to both these recreational cavers and karst scientists might cause discomfort as participants question authority, expertise, motive, and lack a personal connection to other forum participants.

Innovative and attractive portal features, capturing a universal appeal of karst and cave information could engage both scientists and recreational cavers. One such project, currently in the planning state, is the Great Karst Trail, an effort to build an online trail system in which users contribute locations of trails in karst areas worldwide. This system will also be interactive, as each trail segment will be assigned links to research articles, images, or any other relevant information, and will include a *wiki* (a web-page-generating database that can be expanded and edited by users), designed to permit KIP users to comment on trails or refine information that others have left. Through this visual means to explore caves throughout the world, enables all members of the CoP to display their photographs and exploratory feats, while simultaneously unifying the community and increasing engagement in the KIP. Furthermore, the

emphasis on KIP's collaborative nature and international reach distinguishes this project from others, highlights the KIP unique community niche of mutually engaging the CoP and centralizing access to karst-related information.

Conclusion

Applying the Communities of Practice model to the KIP is an innovative method for other libraries, serving interdisciplinary communities, to assess and understand how their target users they create, engage, and symbolize data and information.

Recognizing the significance of multidisciplinary studies, libraries are responding through the creation of collaborative portals that foster both community and research.

The Karst Information Portal, hosted at the University of South Florida Libraries, is one such project. Through this research, the authors actively seek to understand the information values and practices that shape the distinctive practitioners, scientists, and professional community that the KIP serves. As such, the Karst Information Portal fulfills the emerging role of academic libraries to facilitate and support the study, practice, and research of a distinctive knowledge community. While libraries need to respond to the changing needs of their scholarly communities, understanding the broader Community of Practice that they serve is also of critical importance.

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